The Role of Advanced Signal Detection Techniques in the Development of High-resolution, Accurate Decision Support Systems

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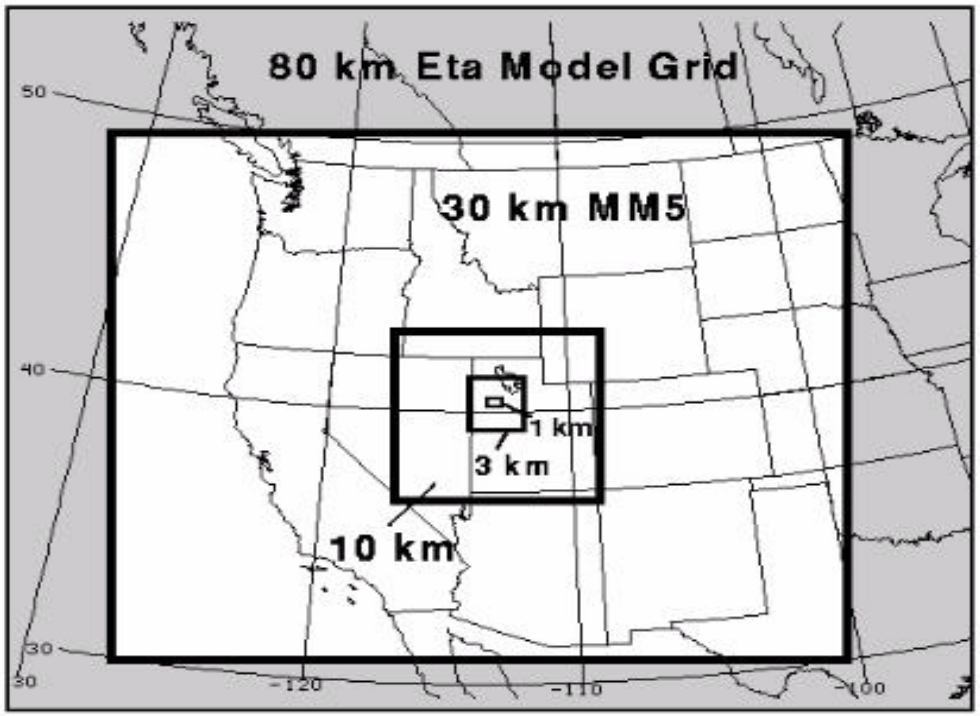
NCAR Applications of Numerical Modeling to Decision Support Systems

- Co-developer of the MM5 mesoscale model
- NCAR uses mesoscale model in all DSS's
- Currently running highest resolution operational model in the world (Army test ranges)

West Desert Test Center



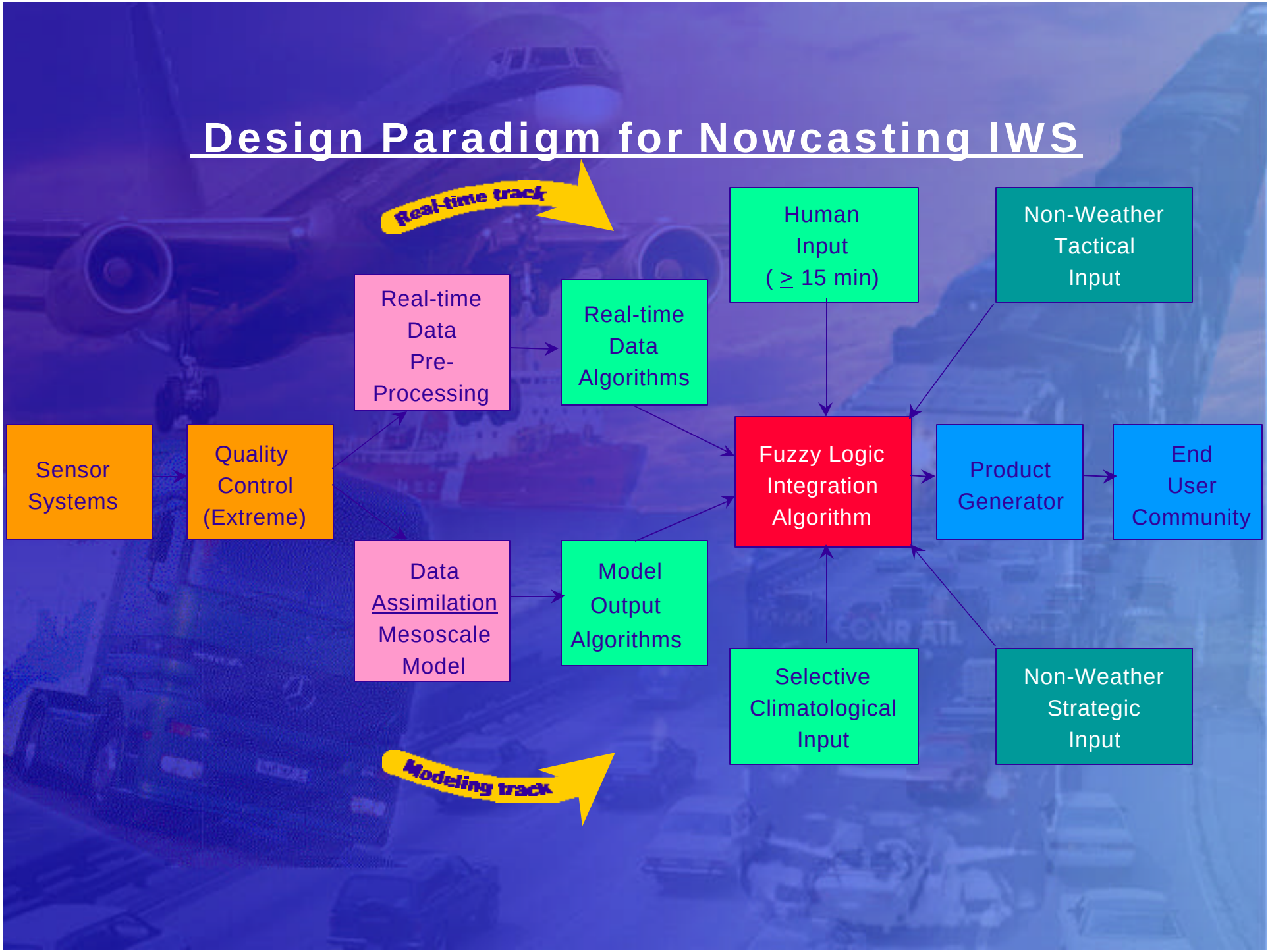
MODEL CONFIGURATION

Grid	# Grid Pts	Grid Size	# Sfc Obs
Domain 1	98 x 64	30 km	> 200
Domain 2	70 x 67	10 km	> 100
Domain 3	61 x 61	3.3 km	29(64)
Domain 4	37 x 28	1.1 km	11

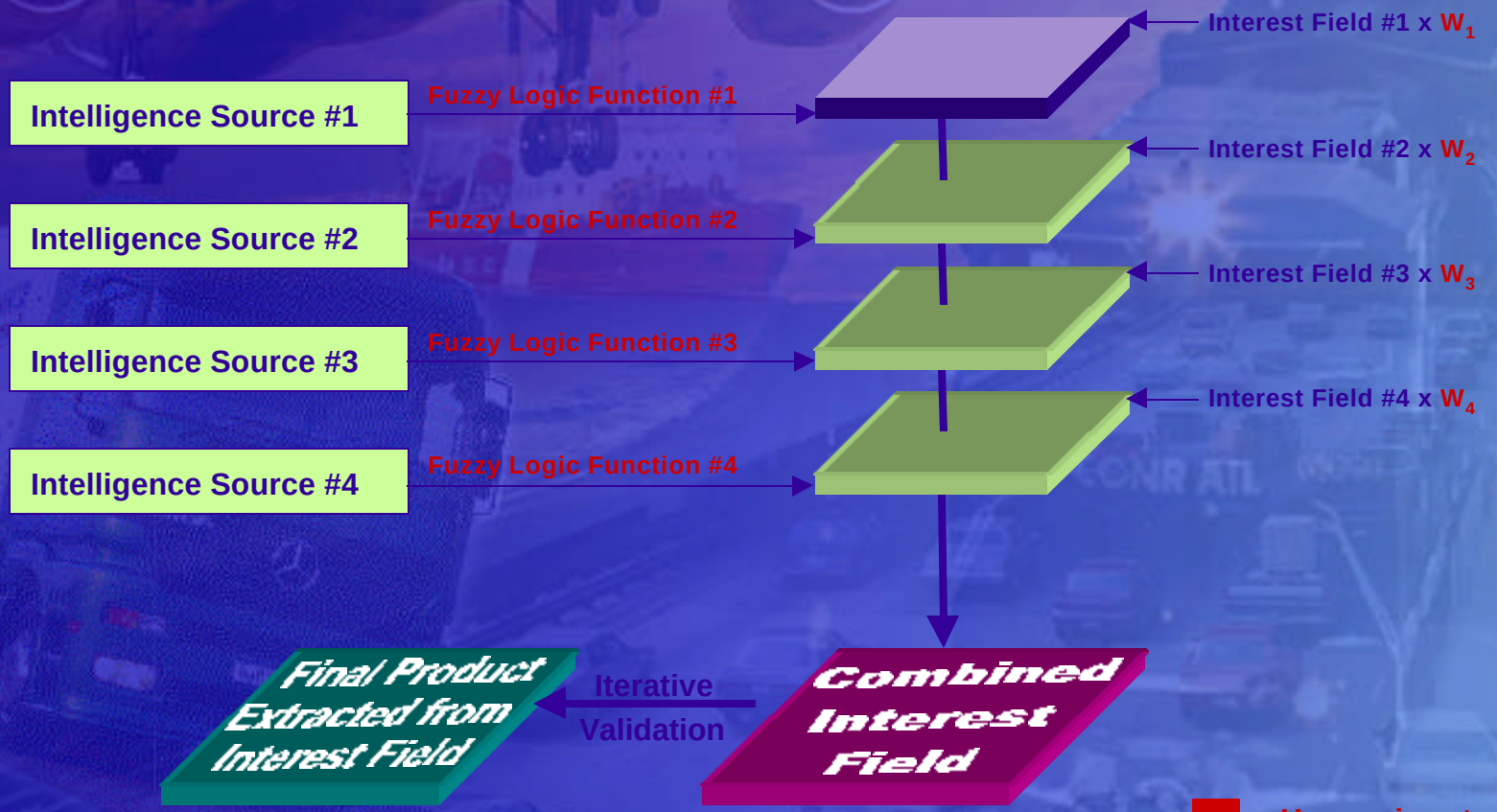
The Problem: Detect a Weak Signal in a Noisy Environment

- Example 1: Detect intense, fine-scale thunderstorm that may be producing a local flash flood or debris flow
- Example 2: Detect presence of all 1-mile road segments that have visibilities below a set threshold
- Example 3: Detect presence of precipitation on all 1-mile road segments

Design Paradigm for Nowcasting IWS



Fuzzy Logic Mapping/Merging of Intelligence Sources & Product Extraction



How Fuzzy Logic Differs from Statistical Methods

- Statistical methods are derived from Boolean Logic and thus require classification of data (yes or no)
- Fuzzy logic allows continuous values; no classification required; functions derived from human experts

Characteristics of Intelligent Weather Systems

- **Semi-automated or fully automated**
- **Mimics human forecaster process**
- **Based on synthesis of data from multiple weather sensors and numerical weather models**
- **Quality control of weather data is robust and comprehensive**
- **Precision detection of weather events in space and time***
  - Probability of detection ≥ 90%
  - False alarm rate (over-warning) ≤10%
  - Space resolution about 1 mile
  - Time resolution about 1 minute

*Data-rich areas